

WE CLAIM:

1. A method for reserving resources for at least one flow of packets on an MPLS based path in a network:

(a) identifying at least one flow of packets from a connection to a destination, wherein at least one flow of packets is associated with a required resource for forwarding each packet in at least one flow towards the destination over the network;

(b) employing a first type of message to establish an LSP in the network for at least one flow from the connection towards the destination; wherein the LSP is established from an ingress router to an egress router in the network;

(c) employing a second type of message to reserve the required resource at each router along the LSP for at least one flow of packets from the connection; and

(d) when a new resource is required for at least one flow of packets from the connection, employing the second type of message to reserve the newly required resource at each router that employs an enhanced MPLS (EMPLS) protocol and is disposed along the existing LSP, wherein a new path is established by the first type of message for that portion of the existing LSP that includes a router that employs an MPLS protocol, instead of a router that employs the EMPLS protocol.

2. The method of Claim 1, further comprising a set of labels, wherein each label corresponds to a router that forwards it towards the next router along the LSP, wherein the label includes an EXP field, and wherein the EXP field includes an EMPLS indicator in each label that is forwarded by each router that employs the EMPLS protocol.

3. The method of Claim 1, subparagraph (c), further comprises employing the same label with the second type of message as the first type of message to ensure that the message is forwarded to each router along the LSP.

4. The method of Claim 1, sub-paragraph (a), further comprising determining that the packets in a flow have the same forwarding equivalence class (FEC).

5. The method of Claim 1, sub-paragraph (c), further comprising when at least two flows of packets from the connection have the same forwarding equivalence class (FEC), employing an aggregated RSVP message to reserve resources along the LSP for each flow of packets with the same FEC.

6. The method of Claim 1, sub-paragraph (d), further comprising:

(a) employing the first type of message to set up the new path for that portion of the existing LSP that includes at least one router that employs the MPLS protocol; and

(b) establishing a new LSP that includes the new path in combination with another portion of the previously existing LSP that includes each router that employs the EMPLS protocol and is disposed along the previously existing LSP.

7. The method of Claim 1, further comprising tearing down the existing LSP when at least one flow of packets from the connection is stopped.

8. The method of Claim 1, further comprising tearing down the existing LSP when the connection is closed.

9. The method of Claim 1, subparagraph (b), wherein the first type of message is at least one of an RSVP message or an LDP message..

10. The method of Claim 1, subparagraph (c), wherein the second type of message is an RSVP RESV message.

11. A method for dynamically modifying resources for a label switched path in a network:

- (a) identifying a connection, wherein the connection includes one or more flows of packets that has an associated resource requirement;
- (b) determining resources for the one or more flows of packets associated with the connection;
- (c) establishing the label switched path, wherein a first label is associated with the label switched path and the packets of the one or more flows of packets associated with the connection;
- (d) reserving resources along the label switched path for the one or more flows of packets associated with the connection by sending a first message that contains the first label along the label switched path that reserve the resources;
- (e) forwarding the one or more flows of packets associated with the connection along the label switched path;
- (f) determining whether a change of the resources requirement has occurred; and
- (g) when a change of the resource requirement has occurred, modifying the resources reserved along the label switched path by sending a second message that contains the first label, wherein the second message alters the resources reserved while avoiding establishing a new label switched path, whereby processing is minimized.

12. The method of Claim 11, further comprising:

- (a) determining whether the method operates within one of an enhanced Multi-Protocol Label Switching portion of the network and a non-enhanced Multi-Protocol Label Switching portion of the network, wherein the network is a heterogeneous network;
- (b) when a change in resource requirement has occurred, tearing down the label switched path for the non-enhanced Multi-Protocol Label Switching portion of the network; and
- (c) establishing a new label switched path for the non-enhanced Multi-Protocol Label Switching portion of the network.

13. The method of Claim 11, wherein reserving resources further comprises ensuring the resource reservation is along the label switched path by configuring the second message with the first label such that the second message follows the label switched path.

14. The method of Claim 11, wherein the second message includes a second label, the second label including a different value in an extra bit (EXP) field to differentiate the second label from the first label.

15. A router for forwarding packets to a final destination over an Multi-Protocol Label Switching (MPLS) network, comprising:

(a) a transceiver for receiving and transmitting each packet of one or more flows of packets from a source to a destination;

(b) a labeler for labeling each packet with a label according to a forwarding equivalence class (FEC) that corresponds to the label, wherein the forwarding equivalence class (FEC) is based on a kind of data included with each packet;

(c) a pathmaker for assisting in establishing a label switched path along which each packet is forwarded between an ingress router and an egress router of the enhanced Multi-Protocol Label Switching (MPLS) network, wherein the label switched path corresponds to the label of each packet;

(d) a reserver for assisting in reserving resources along the label switched path, wherein the reserver further assists in dynamically modifying resources reserved along the label switched path while avoiding establishing a new label switched path; and

(e) a scheduler that forwards each received packet along the label switched path towards the egress router, wherein the egress router removes the label and forwards each packet.

16. The router of Claim 15, wherein the pathmaker and reserver operate independently from one another while maintaining a common association according to the label.

17. The router of Claim 15, further comprising a label information base that stores a list of labels and a mapping of a relationship between each label and forwarding equivalence class (FEC).

18. The router of Claim 15, wherein the labeler examines the label of the received packet to identify the kind of data included in the received packet.

19. The router of Claim 15, wherein the reserver assists in using aggregated RSVP (Resource Reservation Protocol) to reserve resources along the label switched path for packets of different flows that correspond to the same FEC.

20. The router of Claim 15, wherein the reserver assists in using RSVP (Resource Reservation Protocol) to reserve resources along the label switched path for packets of the same flow that correspond to the same FEC.

21. The router of Claim 15, wherein the reserver assists in transmitting a message to reserve the resources along the label switched path, wherein the message includes the label.

22. The router of Claim 15, wherein the label is a first label and the reserver assists in transmitting a message for reserving resource that includes a second label such that the message follows the label switched path but is discerned from packets containing the first label.

23. The router of Claim 22, wherein the second label includes a different value in an extra bit (EXP) field to differentiate the second label from the first label.

24. The router of Claim 15, wherein the transceiver, labeler, pathmaker, reserver, and scheduler are enabled to operate as an ingress enhanced label switching router (ELSR), an intermediate enhanced label switching router (ELSR), and an egress enhanced label switching router (ELSR).

25. A method for reserving resources for at least one flow of packets on an MPLS based path in a network:

- (a) means for identifying at least one flow of packets from a connection to a destination, wherein at least one flow of packets is associated with a required resource for forwarding each packet in at least one flow towards the destination over the network;
- (b) means for employing a first type of message to establish an LSP in the network for at least one flow from the connection towards the destination; wherein the LSP is established from an ingress router to an egress router in the network;
- (c) means for employing a second type of message to reserve the required resource at each router along the LSP for at least one flow of packets from the connection; and
- (d) when a new resource is required for at least one flow of packets from the connection, employing means for using the second type of message to reserve the newly required resource at each router that employs an enhanced MPLS (EMPLS) protocol and is disposed along the existing LSP, wherein a new path is established by the first type of message for that portion of the existing LSP that includes a router that employs an MPLS protocol, instead of a router that employs the EMPLS protocol.